



– PRODUCTION GUIDELINE –



agriculture,
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— PRODUCTION GUIDELINE —

Grapes

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GENERAL ASPECTS

Classification

Scientific name: *Vitis* spp.

Common names: raisins (French), Trauben (German), druiven (Dutch), budo Japanese, pu tao (Chinese), trapezou (Greek), druer (Norwegian), vindruvor (Swedish)

Names used by different communities in South Africa: duiwe (Afrikaans), moretwa wa sekgowa (Setswana), morara (Sepedi)

Origin and distribution

The exact origin of grapes is unknown, although some believe that they originated from Asia. Grapes have been distributed largely in East Asia, Europe, the Middle East and North America. The cultivars were carried to Greece, Rome and France before 600 BC. Also, the Romans spread grapes throughout Europe, and they were moved to the Far East *via* traders from Persia and India. Spanish missionaries brought them to the US in the 1700s.

Production levels

South Africa

The South African table grape export industry is situated in mild Mediterranean and arid subtropical climates. More than 80% of table grape



production in South Africa occurs in the Western Cape region. Other production areas include the Northern Cape, Eastern Cape, Limpopo, Free State and Mpumalanga.

Internationally

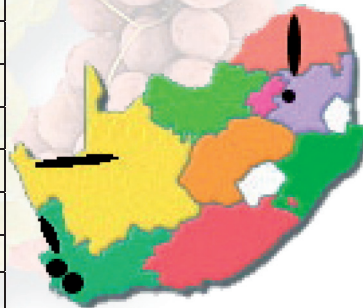
Table grapes are among the most traded fruit types in the world. In 2009,

South African table grape exports totalled 2 708 767 metric tons. Europe is the most important market. Most table grapes were exported to the Netherlands (40%), followed by Great Britain (21%), Belgium (7,4%), Germany (5,5%), Hong Kong (3,1%) and other African countries (0,3%). During the summer season, India, Chile, South Africa and Israel are the major competing countries. Chile exports approximately 20% more table grapes to Europe than in the past (DAFF Directorate: Statistics).

Major production areas in South Africa

The Hex River Valley is the country's main table grape production area; more than half of all grape exports come from this district, which has the longest harvesting period in the country. The Northern Cape is a very dry province, so most of the grapes in this province are cultivated in the Orange River region and they are harvested very early. Other regions are in the Eastern Cape and Free State provinces and the Olifants River region in Limpopo Province.

Province	Regions
Western Cape	Stellenbosch
	Paarl
	Constantia
	Walker Bay
	Robertson
	Franschhoek
	Worcester
	Little Karoo
Northern Cape	Orange River
Limpopo	Olifants River



Cultivars

Major considerations in choosing table grape varieties are market demand and, in some regions, disease resistance of cultivars. Popular cultivars are Barlinka, Bonheur, Dauphine, Waltham Cross, Alphonse Lavallée, Red Globe, La Rochelle, Sunred Seedless, Thompson Seedless and Sultanas. Cultivars should match the climate. It is not by chance that very dry areas (deserts) are the leading areas for commercial table grape production.

Prime

This is the earliest South African seedless variety. It has a light Muscat flavour and a fresh and crispy new season taste and it ripens in the second half of November.

Flame seedless

This is the first South African red seedless grape variety. It has a very attractive colour and very good flavour and is available in December.

Sugraone

This is a white seedless variety with exceptionally large berries for an early seedless variety. It has a good shelf life and is available in December.

Description

Mature plant

All grapes are woody, climbing vines. Grapevines use tendrils to attach themselves to other tall-growing plants. Their shoots extend to nearly a metre a year because most of the energy goes into growth in length and not in girth. Tendrils occur opposite leaves at nodes and automatically begin to coil when they contact another object. Grapes are cultivated on a trellis, fence or other structure for support.

Leaves: Leaves vary in shape and size, depending on species and cultivar. Muscadine grapes have small, round, unlobed leaves with dentate margins. Vinifera grapes have large cordate to orbicular leaves, which may be lobed. Leaf margins are dentate.

Buds: Buds are compound in grapes, meaning that they have multiple growing points or meristems.

Flowers: Flowers are small, indiscrete, and green, borne in racemose panicles opposite leaves at the base of the current season's growth. Each flower has sepals, petals and stamens. Ovaries are superior and contain two locules, each with two ovules. The cap is the corolla, in which the petals are fused at the apex, it abscises at the base of the flower and pops off at anthesis.

Fruit: Grapes are true berries, small, round to oblong and consisting of four seeds. Berries are often glaucous, having a fine layer of wax on the surface. The skin of the grape is thin and is the source of the anthocyanin compounds that give rise to red, blue, purple and black (dark purple) coloured



grapes. Green and yellow-skinned cultivars are often termed “white” grapes. Muscadine differs from other cultivar because it has thick skin which is sometimes bitter and tough. The fruit of the muscadine ripens one by one and detaches from the plant at maturity. The berries detach from the vine with a dry stem scar unlike bunch grapes, which remain attached to the cluster at maturity.

Essential parts

The essential part of the grapes would be determined by the intended end use of the plant. Grapes can be eaten fresh or dried or enjoyed in the form of juice and wine.

Climatic requirements

Temperature

Table grapes typically require a hot, dry climate, i.e. warm days, cool nights and low humidity. These generally produce higher-quality grapes. The season at a particular site must be long enough to allow both the fruit and the vegetative parts of the vine to mature. It must provide enough heat energy to ripen the fruit and vegetation. There must be adequate sunlight hours to ensure that a sufficient supply of carbohydrates is produced by photosynthesis to mature the fruit and vine and to maintain future productive potential for healthier vines and sweetness of the fruit. There must be very little rain during the ripening period—this will prevent various grape diseases. Winter must be long enough to ensure a period of dormancy for the vines, and there should be no late frost because it will be a threat to the young buds. They are sensitive to freezing temperatures, which normally occur in winter and can damage and destroy flower clusters.

Water

Grapes require enough water for better production. Grapes are less tolerant to waterlogging and water stress. The volume of water required is de-

terminated by soil depth and soil bulk density. Soil texture influences soil bulk density, water drainage and water-holding capacity. In areas with summer rainfall the combined effect of these factors determines the volume of water which will be available to grapevines between rains. In South Africa it is difficult to grow table grapes in areas receiving rain during the ripening period of the grapes, although this depends on the variety. The Lower Orange River region produces earlier table grapes, and therefore there must be little rain during the ripening period to prevent various grape diseases.

Soil requirements

Table grape vines must be vigorous to ensure high yields and quality; the better the soil, the healthier the vines and the greater the chance for high tonnage and quality. Table grapes can be grown in a wide variety of soil types. The most important characteristics are good internal drainage and adequate depth. Waterlogged soils will lead to a reduction in vine health and added difficulties in vineyard management. Grapevines require deep, well-drained soil with a minimum of 75 cm to 1 m of permeable soil with no impeding layers (shallow bedrock, chemical or physical hardpans) for optimum vine growth. Although grapevines can be grown in different soil types, they grow well in a sandy loam soil with average fertility. Regardless of soil type, the drainage must be good because this will help the roots to spread and grow well. Avoid growing grapes in soils that contain clay because it may cause poor drainage and salt accumulation. Grapes are fairly tolerant to a wide range of soils and pH, but do well in a pH of 5,5 to 6,0.

CULTIVATION PRACTICES

Propagation

Choose certified and disease-resistant rootstock. The most frequent method of grape propagation is bench grafting. However T-budding, layering, and rooted cuttings and (to a limited extent) tissue cultures are used in various situations. The most common method of muscadine propagation, trench layering, is used by specialised nurseries. If the soil is to be used for the first time (virgin soil), it must be cleared of weeds, tree stumps and stones. Ensure that wet spots are drained and that the planting site is levelled. Too much subsoil is not recommended on the surface as it will contribute to a poor growth rate. Grapes prefer deep, well-drained, sandy, or gravelly loam soils. Excessively wet or dry soils should be avoided. Adequate soil preparation is essential because grapes are deep-rooted,

long-lived plants. Work on the soil to remove perennial weeds, and add humus (peat moss, compost, or aged manure) to improve soil quality.

Planting

Plants can be bought in the spring as bare-root or potted plants. Make sure that you buy dormant, bare-root grapevines from a reliable nursery or garden centre. When planting, set the plant in a well-prepared hole of the same depth as in the nursery. At planting time, cut grapes back to three or four buds. Plant grape seedlings eight to 10 feet (METRE????) apart in a home garden. They can be closer if used for a fence cover, arbour or trellis.

Plant one-year-old seedlings and wait for three years for them to produce maximum yields. Make sure that you buy dormant, bare-root grapevines from a reliable nursery or garden centre. Plant grape seedlings three to four weeks before the last hard frost of spring. The vines must be dormant and must not dry out before planting. Make sure vine roots are soaked two to three hours before planting.

Grafted cultivars must be planted with the graft above the soil line. Make sure that the grafts are not placed below the soil line because this will produce unwanted suckers. It is important to plant at the same soil depth as in the original container. Planting rows should run at right angles to the slope. In areas that are normally very windy, plant in the direction of the wind to minimise damage.

Fertilisation

Soil fertility should be moderate for grapevines. Soil that is too fertile with subsequent excessive vegetal growth can be problematic; in contrast, impoverished soils can require expensive applications of nutrients. It is important for the farmer to know the recent status of soil, so test the soil/soil sample and make recommended amendments before planting. Therefore, perform soil tests every three years as a guide. After a year, apply fertiliser 30 days before new growth begins. Additional nitrogen should be applied if the cane growth is 1 m or less in a year. Additional nitrogen must be applied to avoid nitrogen deficiency. The leaves will show poor colour (light green or yellowish). This is more noticeable on older leaves and during early defoliation. On the other hand, high nitrogen fertilisation promotes heavy vine production at the expense of fruit production. Application of phosphate is beneficial. Fertilisers are applied two to four times a year.

Irrigation

Irrigation to supplement natural rainfall is a requirement for consistent, successful table grape production. Water must be available in adequate quantities when it is needed and the water must be of suitable quality for irrigation. Water quality concerns primarily involve salinity and the quantity of dissolved salts. Existing water wells should be tested for water quality to determine their suitability for grape production. Chlorides or boron in irrigation water may accumulate in grape leaves, and water that is high in sodium may reduce the water permeability of soil. Salts also accumulate in soils and can reduce grape yields. The volume of water required may change in response to day length and growth stage. Young vines grow best if they are watered on a regular basis; apply at least 20 litres per vine per week in two to three applications. Some farmers use a drip irrigation system. It is advisable to keep a weed-free environment to avoid water stress because this will promote growth. Mature vines require 100 to 300 litres of water per vine per week in one to three applications. Seasonal changes may affect the volume of water needed and growth stages. It is important to maintain soil moisture during the critical growth stages of budburst, flowering period, fruit setting and berry ripening. These periods can be extended by moist conditions. In most cases it is recommended that farmers use tensiometers to monitor soil moisture. They make it possible to apply the optimum volume of water when it is needed.

Weed control

Maintain a weed-free environment because during the growing season, weeds suppress the grape crops and this leads to competition for moisture and nutrients, especially if the plants are still young. For better growth, make sure that the yard is clean from early spring until midsummer. Removing perennial weeds from planting sites and keeping growing vines free of competing weeds are essential aspects of grape growing. Mulching is a valuable way of eliminating many problem weeds.

The method of weeding depends on the weed pressure and weeding can be done by three methods, i.e. mechanically, chemically and biologically.

Mechanical method

Weeds can be controlled by hand hoe. The hoe is used to control and remove weeds that surround the bark/trunk. To control weeds, grapevines should be cultivated, using a flat cultivator, a disk or a roller. Avoid cultivation when roots begin to spread out.

Chemical method

Weeds can be controlled through the application of herbicide, depending on species. Follow the label instructions carefully. The use of herbicides is a risk to soil that has a low organic matter content but it remains acceptable although it is harmful to the soil structure. This method must be repeated each year.

Biological control

Grasses can be used for mulching. They must be left on the soil surface to suffocate and repress emergent summer weeds. Any disturbance of the soil will destroy the weed-controlling effect of the mulch. Mulching reduces tillage during the growing season.

Pest control

Pesticides and fungicides are applied from early spring up to harvest.

Grapes are frequently attacked by grape berry moth, whose larvae feed on grapes, and by birds, which are highly attracted to the grapes. It is difficult to control these pests.

Disease control

Disease control is critical for grape production. To control diseases, use resistant cultivars. Prune the plants. When necessary and if possible, apply fungicides. Sanitation is also important. The following diseases are common when rainfall, humidity and temperatures are high:

POWDERY MILDEW

Any part of the plant (leaves, blossoms, fruit and young leaves) can become affected. This is more important from the viewpoint of the export of fresh grapes. The disease leaves blemishes on the affected berries and results in deformation.

As the name suggests, the first symptom is the appearance of a white powdery (ash-like) substance on the leaves, young shoots and immature berries. The disease is common under warm and dry conditions.

Control: Apply the fungicide at bud break in vineyards where symptoms appeared the year before and follow the label instructions carefully. Consult your local (provincial) department of agriculture for recommendations on the latest fungicides.

DOWNY MILDEW

As the name suggests, the disease is caused by light and continuous rain or heavy dew associated with high humidity, or low temperature also favours the development of the disease. It attacks the leaves, flowers, clusters and young fruit. The first symptoms are light-yellow spots on the upper surface of the mature leaves corresponding with white spots on the lower side. The affected leaves turn brown and cannot support bunch development owing to reduced photosynthetic activity.

Control: Pruning is recommended and it is economical. Prune the vines after the second week of October. This will help minimise the damage from the disease. All the affected parts must be removed at the time of pruning and be destroyed immediately. Consult your local (provincial) department of agriculture for recommendations on the latest fungicides.

BACTERIAL LEAF SPOT

The disease is more frequent from February to March and in June and August when the temperature is 25 °C to 30 °C and humidity is 80% to 90%. The first symptoms appear on young growing shoots. This disease infects leaves, shoots and berries. On the leaves it appears as minute water-soaked spots on the lower surface of the leaves along the main and lateral veins. The spots coalesce later to form larger patches and brown-black lesions on the berries, which become small and shrivelled.

Control: The easiest method is to collect and burn the infected plant parts; this will help minimise the spread of the disease. For recommendations consult your local (provincial) department of agriculture for the latest copper fungicides.

BLACK ROT

The disease occurs more frequently in areas with a warm and moist climate and extended periods of rain and cloudy weather. The disease attacks the leaves, stems, flowers and berries. It is likely that all the new growth will be attacked during the growing season. The symptoms are usually reddish-brown spots on the leaves and a black scab on the berries.

Control: Mummified berries left on the vines should be collected and destroyed. It is important to cultivate the soil to improve the circulation of air.

Other cultivation practices

Bench-grafting is unusual in that the rootstock is either bare-rooted or unrooted at the time of grafting. The ease with which grape rootstocks root



from dormant hard-wood cuttings allows the propagator to handle the plants in this manner.

Harvesting

Because of their high-quality requirements at the point of sale, table grapes demand manual labour, technical knowledge and experience. Grapes

should be harvested when fully ripe. Colour does not always indicate maturity, so taste-testing is often the best method. Grape clusters should be cut from the vines with a sharp knife.

Harvest maturity

Grapes should be picked when the fruit reaches the desired ripeness for its intended purpose. As the fruit ripens, the colour changes, the sugars increase and the acids decrease. The timing will vary from year to year. Berries should be sampled daily as the harvest approaches to determine sugar, acid and pH levels. Fruit quality can change under warm conditions.

Grapes can be kept on the vine for several weeks after maturity or if picked and stored in a very cool, dry, well-ventilated place. As long as no berries are dropping it is best to leave the crop on the vines and pick the grapes as demanded by the market. Unless the weather is rainy, there will be no deterioration. If well protected by foliage, the grapes will withstand cold weather.

Possible damage to the crop by birds and bees must be considered in the decision as to whether or not the mature crop should be left on the vine.

Harvesting methods

To harvest the grapes, use a grape knife or harvesting shears/scissors. Hold the grapes with one hand and cut upward, away from your hands and arms to prevent injury. Hand shears are safer but are slower and more difficult to use. Do not jerk or pull clusters from the vine as this may crush

some of the grapes. Discard all green, immature or diseased fruit. Gently place the fruit into harvesting lugs or boxes and handle as little as possible. Take the container into the shade as soon as possible.

POST-HARVEST HANDLING

Sorting

Sorting of grapes can be done by two different methods—by hand or electronically. For the grapes to be sorted effectively the grower has to use many workers. Sorting should always be done in the vineyard first. The grapes are destalked and then put onto the sorting table, which moves the berries by means of vibrations. During sorting, leaves, stalks, snails and uncoloured berries that come through the destemmer are removed. The grapes are then crushed and put into the fermenter without leaves and stalks.

Electronic sorting is expensive, but it has been used successfully. Fruit is fed onto a horizontal conveyer belt and then dropped onto another horizontal conveyer belt. Between these conveyer belts are sensors and lasers that are connected to a computer. The computer has been programmed to distinguish between different-coloured fruit by running fruit with desirable and undesirable qualities past it. If the computer recognises that fruit falling through the air does not meet the specifications it is shot out of the air by an air nozzle and then lands onto another conveyer belt.

The use of this technology makes it possible to sort individual berries according to differences in size (eliminating small green berries or large berries), and to eliminate berries that are not fully coloured, along with stalks, leaves, pine needles, insects and berries showing signs of botrytis, mealy-bug, bird damage, etc.

Table grapes: Packing and shipping occur immediately after harvest when possible and storage is necessary when volume exceeds demand. Grapes must be cooled in forced-air rooms and fumigated with sulphur dioxide (SO₂) to reduce fungal decay.

Raisins: Before harvesting, soil between the rows is smoothed to accommodate trays or papers used for field drying. After grapes are picked and placed into drying papers in single layers, machines will then collect dried raisins from paper trays and place them in storage. During the first few weeks of storage, dry the grapes in the dehydrator for 12 to 24 hours or until they are free of moisture. After this procedure, raisins are packed into boxes for sale.

Wine grapes: Harvested grapes are destemmed and crushed. Then the juice is extracted and fermented into wine. Initial quality evaluations are made and the vinification process is decided upon. Adjustments of sugar level and acidity can be done at this point. Sulphur dioxide is added to prevent oxidation and colour deterioration.

Grading

The harvested bunches are graded according to the size of their berries and their colours. Before grapes are packed the decayed, undersized, broken and discoloured berries are removed by their pedicels from the selected bunches, using long scissors. It is important for the workers to wear rubber gloves.

Packing

Grapes for the local market are packed into ventilated, corrugated boxes accommodating 2 kg to 4 kg of grapes. The boxes are lined with fine shredded paper, which is spread at the bottom and the top of the box for protection (cushioning). The open flaps of the box are secured firmly by means of adhesive tape. Grapes that are sent to foreign markets are packed in five-ply corrugated boxes, 500 × 300 mm in size to accommodate 5 kg of grapes. The graded bunches are weighted into 5 kg lots of plastic trays. One or two bunches weighing between 350 g and 650 g are placed in small, thin polythene pouches. Before the pouches are placed into the carton, a sheet of bubble wrap is spread with its rough surface facing toward the base of the box. A white, soft polythene liner is spread over the top of the bubble sheet. These pouches are arranged in a single layer before precooling of the grapes. After precooling, dual purpose SO₂ release pads are placed over the pouches and the polythene liners are folded in.

Storage

The grapes should be precooled promptly after harvest in separate rooms with large refrigerating capacity, high relative humidity and high air velocity. They are normally precooled at 1 °C to 2 °C within six hours of harvest. After precooling, the dual releasing SO₂ pads are placed with their coated surfaces downwards on the filled plastic pouches and covered with the polythene liner. The boxes are closed and shifted into cold storage. The arrangement of the boxes in cold storage is very important to ensure uniform cooling of all the berries in all the boxes.

Transport

The cool chain is essential during the transport of export quality commodities all the way from the farm to the customer. It helps to maintain the temperature inside the box at the same low level as in cold storage.

The various stages of the cool chain are:

- Coldstore at the farm
- Refrigerated truck from the farm to the airport or harbour
- Coldstore at the airport or harbour
- Packing of the pallet into a coldstore in a short time
- Maintaining coldstore temperature in the hold of the cargo aircraft

Marketing

No grapes should be planted without a marketing plan, and a total management plan should always precede planting. If the grower wants to concentrate on early marketing he/she must plant early grapes. The grower's choice of cultivars will still depend on the requirement of the market. Some of the cultivars are suitable for the local market, for example Pirobella. This is because its berries are too small for export. Distance to the harbours can be a major constraint for the export market if any existing cultivars are planted. Cultivars like Queen of the Vineyard and Alphonse Lavallée are suitable for the export market because they are of good quality.

PRODUCTION SCHEDULE

Activities	January	February	March	April	May	June	July	August	September	October	November	December
Soil sampling							X					
Soil preparation										X	X	
Planting								X	X			
Fertilisation	????											
Irrigation			X	X	X							
Pest control	????											

Activities	January	February	March	April	May	June	July	August	September	October	November	December
Disease control			X	X	X				X	X		
Weed control			X	X	X					X		
Pruning						X	X					
Harvesting	X										X	X
Marketing	X										X	X



UTILISATION

Grapes are consumed as fresh or dried fruit, or as juice. As dried fruit, it is used in cakes, sweets and salads (raisins, currants and sultanas). It is also used for making jam.

Grapes are the main substance of wine. Grape vinegar is generally used as flavourant in salad dressings (e.g. mayonnaise), marinades, chutney, pickles and achar. Because of its preservative qualities, vinegar is used for food preservation, e.g. canned fish, meat and vegetables.

Grape seeds have antioxidant characteristics and are used in the pharmaceutical industry.

REFERENCES



Further information can be obtained from

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